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Anterior chamber depth measurement: Experimental slit lamp method versus applanation a-scan

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Abstract

Accurately measuring anterior chamber depth is critical in placing an intraocular lens after cataract surgery. The current method most commonly used to measure the distance from the posterior surface of the cornea to the anterior surface of the crystalline lens is ultrasound biometry. This project explored the efficacy of a simple optical instrument to measure anterior chamber depth (ACD) compared to that of applanation A scan ultrasound. The mean ACD measured by the A scan was 3.40mm (range 2.87 to 3.87 mm) while the mean ACD measured with test instrument was 3.61mm (range 3.00 to 4.llmm). The ACD measured with the test instrument was greater in 5 of the 6 eyes when compared with the A scan. The difference ranged from .06 mm shorter to 0.44 longer (mean +0.22±0.19. At-test revealed no significant difference in the two sets of measurements with significance of 0.001

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Subject Categories

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ANTERIOR CHAMBER DEPTH MEASUREMENT: EXPERIMENTAL SLIT LAMP METHOD VERSUS APPLANATION A-SCAN

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Key Words: Anterior Chamber Depth, A Scan, Ultrasound, Applanation

Anterior chamber depth measurement: Applanation A-scan versus experimental slit lamp method

by

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Introduction

Accurately measuring anterior chamber depth (ACD) is critical in placing an intraocular lens after cataract surgery. An error in measurement or placement as small as 0.25 mm can cause significant visual discomfort. The current method most commonly used to measure the distance from the posterior surface of the cornea to the anterior surface of the crystalline lens is ultrasound biometry. This project explores the efficacy of a simple instrument to measure anterior chamber depth compared to that of applanation A-scan ultrasound.

Instrumentation

The instrument being tested in this study is a micrometer caliper attached to the slit lamp axle that measured the slit lamps forward translation when moving focus from the anterior surface of the cornea to the anterior surface of the lens. The caliper was secured to an aluminum strip anchored to the slit lamp stage. The micrometer used had a digital scale on the side that displayed the distance down to the nearest .01 μm.

Methods

6 eyes of 3 optometry students were measured using the Humphrey 835 A scan ultrasound. Subjects had no history of eye disease except low refractive error. Refractive error ranged from +0.50 to -4D (average 2.16D). Astigmatism ranged from 0 to 1.5D (average 0.42D). Each eye was measured using applanation ultrasound biometry. Three readings were taken and averaged. Central corneal thickness was then measured three times for each eye using Sonogage Corneo-Gage^{tm} ultrasound pachymetry and an average was calculated. To calculate the ACD using the test instrument several factors were

taken into account. Since the focus on the front surface of the cornea was actually on that of the tear film, 7 υm were subtracted from the gross value. Also, the thickness of the cornea needed to be accounted for since we were interested in the distance between the posterior surface of the cornea and the anterior surface of the lens. Our final adjustment was for the index of refraction of the aqueous humor, 1.336[1].

Results

The mean ACD measured by the A scan was 3.40mm (range 2.87 to 3.87 mm) while the mean ACD measured with test instrument was 3.61 (range3.00 to 4.11). The AC depth measured with the test instrument was greater in 5 of 6 eyes when compared with the A scan. The difference ranged from 0.06 mm shorter to 0.44mm longer (mean +0.22±0.19mm). A t-test revealed no significant difference in the two sets of measurements with significance of $p>0.05$.

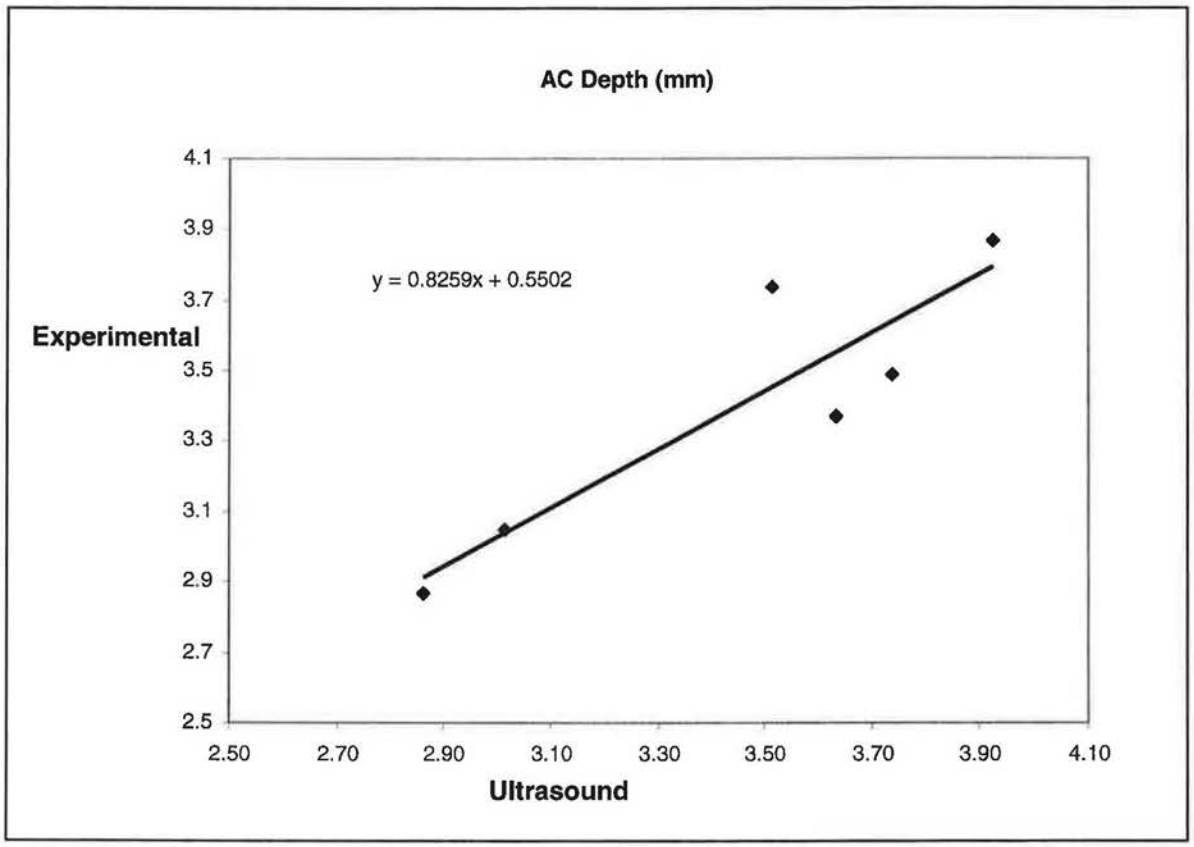

Figure 1. Scatter diagram of measurements by experimental ACD and applanation ultrasound biometry.

Discussion

The purpose of this study was to compare a new technique of measuring ACD to an established and valid existing method. The data obtained via applanation A scan biometry has inherent problems as well as some measurement errors due to poor technique used during data collection. Applanation biometry requires contact of the cornea with a probe, thus compressing the cornea and decreasing the measured ACD by as much as 0.14 mm to 0.22 mm even by the most experienced examiner[2]. This compression could be much more with the inexperienced examiners conducting the test in this study. The higher values obtained using the test instrument can be at least partially attributed to the

compressing cause by the applanation probe. Also, ultrasound biometry techniques have shown to produce significantly shorter measurements when compared to Scheimpflug imaging[3]. Although there was found to be no significant difference between the two measurements the test instrument needs to be retested using a more valid method of determining ACD.

Conclusion

Although this test instrument may never replace ever advancing technologies or existing instruments for measuring ACD it could become an inexpensive teaching tool or used in student research projects. Its application can be extended to measuring other ocular structures such as the lens and cornea as well as distances between these structures.

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BIOGRAPHIES

James Adamek, originally from Powers, Oregon graduated from Linfield College with a B.S. degree in Exercise Science and Mathematics. He plans to go to work after optometry school in private practice.

Dave Coulson hales from Tempe, AZ where he attended Arizona State University and received a B.S. in Biology. He plans on completing a residency in ocular disease and then joining a co-management eye care facility.

Jeff Bergeson grew up in Kingman, AZ and attended Northern Arizona University in Flagstaff, AZ where he received his B.S. microbiology. He plans to return to the AZ area and join a private practice.